JAPANESE / ENGLISH TRANSLATION OF

Japanese Patent Application JP 2002 - 53740 A

Flame-retardant Polyester Resin Composition

Your Ref: 102203 - 20

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(19) Japanese Patent Office (JP)

(11) Unexamined Patent Application No:
Kokai 2002-53740
(P2002-53740A)

(12) Unexamined Patent Gazette (A)

(43) Date of Publication: February 19, 2002

(51) Int. Cl.[7]	Class. Symbols	FI		Theme codes (reference)
C08L 67/00		C08L	67/00	4J002
C08K 5/521		C08K	5/521	

Request for Examination: Not yet submitted Number of Claims: 1 OL (Total of 3 pages [in the original])

(21) Application No.: 2000-243055 (P2000-243055)

(22) Date of Filing: August 10, 2000

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F Terms (Reference): 4J002 CF061 CF071 EW046 EW047 FD136 FD137 GL00

(54) [Title of the Invention] **Flame-retardant Polyester Resin Composition**

(57) [Summary]

[Object] To provide a resin composition that makes it possible to manufacture flame-retardant synthetic resin films and sheets with excellent transparency, flexibility, and handleability by means of using a substitute material for vinyl chloride-based resin and without using any halogen-based flame retardant.

[Means of Achievement] A flame-retardant polyester resin composition obtained by means of adding 5-50 parts by weight of a condensed phosphoric acid ester with an aromatic ring and 5-50 parts by weight of a phosphoric acid ester per 100 parts by weight of polyester-based resin.

[Claims]

[Claim 1] A flame-retardant polyester resin composition obtained by means of adding 5-50 parts by weight of a condensed phosphoric acid ester and 5-50 parts by weight of a phosphoric acid ester per 100 parts by weight of polyester-based resin.

[Detailed Description of the Invention]

[0001]

[Technological Field of the Invention] The present invention relates to a flame-retardant resin composition, especially a flame-retardant polyester-based resin composition with flexibility and transparency that is suitable for processing into sheets, films, and the like (referred to hereinafter and films and sheets), particularly room partition sheets.

[0002]

[Prior Art] Flame-retardant films and sheets made of synthetic resin that are flexible and transparent have been used in the past as room partitions and curtains in factories and the like. Soft films and sheets made of vinyl chloride-based resins have been used as synthetic resin films and sheets that satisfy these types of demands. However, these cannot be called desirable for the environment because they generate acidic gases when discarded and incinerated.

[0003] Positive efforts have therefore been made to develop and study flame-retardant synthetic resin films and sheets using substitute materials for vinyl chloride-based resins. As a result, flame-retardant olefin-based resin films and sheets have been manufactured using substitute resin components in place of vinyl chloride resins, but it was difficult to obtain materials endowed with both transparency and flexibility.

[0004] Imparting flame retardancy by means of adding halogen-based flame retardants is also known. However, the problem was that these generate acidic gases during incineration.

[0005]

[Problems to Be Solved by the Invention] Therefore, an object of the present invention is to provide a resin composition that makes it possible to manufacture flame-retardant synthetic resin films and sheets with excellent transparency, flexibility, and handleability by means of using a substitute material for vinyl chloride-based resin and without using any halogen-based flame retardant.

[0006]

[Means Used to Solve the Above-Mentioned Problems] To resolve such problems, the present invention is a flame-retardant polyester resin composition obtained by means of adding 5-50

parts by weight of a condensed phosphoric acid ester with an aromatic ring and 5-50 parts by weight of a phosphoric acid ester per 100 parts by weight of polyester-based resin.

[0007] Specifically, the present invention is characterized by selecting a polyester-based resin as the substitute material for vinyl chloride-based resin and adding a condensed phosphoric acid ester with an aromatic ring to it as a phosphoric acid ester-based flame retardant jointly with another phosphoric acid ester-based flame retardant, a so-called orthophosphoric acid ester. Through the joint use of such flame retardants, the resin composition of the present invention makes it possible to form films and sheets with excellent transparency and good flexibility.

[0008]

[Embodiment of the Invention] Examples of polyester-based resins that can be used in the resin composition provided by means of the present invention include polyethylene terephthalate (PET), polybutylene terephthalate (PBT), polycyclohexane terephthalate (PCT), and copolymers of terephthalic acid, ethylene glycol, and 1,4-cyclohexane dimethanol (PET-G). Isophthalic acid, neopentyl glycol, cyclohexane diol, and the like may also be copolymerized.

[0009] On the other hand, the type of condensed phosphoric acid ester with an aromatic ring added as a flame retardant to the polyester-based resin used in the present invention is not particularly restricted. However, condensed phosphoric acid esters with a melting point of 80-250°C are preferred from the standpoint of heat resistance, processability, and water resistance.

[0010] The so-called orthophosphoric acid ester used jointly with the aforementioned condensed phosphoric acid ester with an aromatic ring may be one that imparts plasticity to the resin component together with flame retardancy. It is preferable to use one that is liquid at normal temperature. Examples of such phosphoric acid esters include trimethyl phosphate, triethyl phosphate, tricresyl phosphate, trixylenyl phosphate, cresyl diphenyl phosphate, cresyl di(2;6-xylenyl)phosphate, and xylenyl diphenyl phosphate.

[0011] The amount of the aforementioned condensed phosphoric acid ester with an aromatic ring added in the flame-retardant polyester resin composition of the present invention is 5-50 parts by weight, and preferably 10-30 parts by weight, per 100 parts by weight of polyester-based resin. The flame retardancy is lacking when there is less than 5 parts by weight. The mechanical strength of the resulting films and sheets decreases and little improvement of flame retardancy is seen in proportion to the increase in the cost when the amount exceeds 50 parts by weight.

[0012] On the other hand, the amount of orthophosphoric acid ester used jointly with the aforementioned condensed phosphoric acid ester with an aromatic ring is 5-50 parts by weight, and preferably 20-40 parts by weight, per 100 parts by weight of polyester-based resin. Flexibility cannot be imparted to the resulting films and sheets when the amount is less than 5 parts by weight. Processing becomes difficult, blocking develops between the molded products, and handling becomes difficult when the amount exceeds 50 parts by weight.

[0013] Various additives, such as lubricants, antioxidants, antistatic agents, ultraviolet absorbers, photostabilizers, reinforcing agents, pigments, and inorganic/organic fillers, can also be added as necessary to the resin composition of the present invention. The types and quantities of these additives added are not particularly restricted and additives used in the past in polyester-based resins may be added in the same quantities as in the past in accordance with the goal.

[0014] The flame-retardant polyester resin composition provided by means of the present invention is molded into molded products in the form of sheets and films in particular, and is used for room partitions and curtains in factories. To obtain such molded goods, the resin composition of the present invention is melted and kneaded by means of a binder mixer, biaxial extruder, kneader extruder, rolls, or the like; extrusion-molded by means of the curtain method or T-die extruder; and made into films and sheets of the desired thickness. Furthermore, the thickness of the molded products is not generally restricted and varies depending on the use of the films and sheets obtained. For example, sheets about 0.01-1 mm thick may be formed for factory room partitions and curtains.

[0015]

[Working Examples] The present invention is explained in greater detail below through working examples. However, the present invention is not limited to these working examples, alone and various modifications are also encompassed within the scope of the present invention.

[0016] Working Examples 1-5/Comparative Examples 1-3

Polyester-based resins and flame retardants of the compositions shown in Table 1 below were kneaded simultaneously, and 200-μm-thick films were obtained using two 8" rolls. The resin composition of Comparative Example 1 was obtained by means of combining only a condensed phosphoric acid ester having an aromatic ring as the flame retardant. The resin composition of Comparative Example 2 was obtained by means of combining only an orthophosphoric acid ester as the flame retardant. The resin composition of Comparative

Example 3 was obtained using an orthophosphoric acid ester and an ammonium phosphate flame retardant jointly as the flame retardant.

[0017] The transparency, flexibility, and flame retardancy of the films obtained were tested. These results are also shown in the table.

[0018]

[Table 1]

	Working Examples					Comparative Examples		
	1	2	3	4	5	1	2	3
PET-G*[1]	100	100	100	100	100	100	100	100
Condensed phosphoric acid ester*[2]	20	30	10	45	10	30	—	—
Phosphoric acid ester*[3]	30	10	40	45	10	—	30	30
Ammonium polyphosphate*[4]	—	—	—	—	—	—	—	30
Transparency*[5]	o	o	o	o	o	o	o	×
Flexibility*[6]	o	o	o	o	△	×	o	o
Flame retardancy*[7]	o	o	o	o	o	o	×	o

[0019] *[1] Eastar PETG 6763 (made by Eastman Chemical)

*[2] PX200 (made by Daihachi Chemical)

*[3] TCP (made by Daihachi Chemical) (liquid at 25°C)

*[4] Terraju C60 (made by Chisso)

[0020] *[5]: The transparency was evaluated visually.

o Transparent

× Opaque

[0021] *[6]: The flexibility was evaluated by touch.

o Soft

△ Semi-hard

× Hard

[0022] *[7]: The flame retardancy was evaluated based on the 45° microburner method stipulated in Section 4.3 of the Fire Services Act implementation rules.

o Pass

× Fail

[0023] As is also evident from the results in the table, films molded from the resin composition of the present invention have better transparency, flexibility, flame retardancy than do the films of the comparative examples.

[0024]

[Merits of the Invention] By employing the aforementioned construction, the flame-retardant polyester resin composition provided by means of the present invention can be made into a flame-retardant resin composition that has excellent flame retardancy, flexibility, and excellent transparency, and can be used appropriately in products molded into films and sheets with excellent transparency. Therefore, the flame-retardant resin composition of the present invention is useful as a resin composition for manufacturing sheets that require flame retardancy, transparency, and flexibility, such as factory room partitions and curtains. In particular, it is a substitute for vinyl chloride-based resin compositions and is especially outstanding in terms of preservation of the environment when discarded.